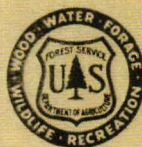


UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

EFFECTS OF THREE SYSTEMS OF CATTLE GRAZING
ON WILLOW SPROUTS IN MOUNTAIN MEADOWS



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STUDY PLAN - WILLOW REPRODUCTION

Title: Effects of Three Systems of Cattle Grazing on Willow Reproduction in Previously Heavily Grazed Mountain Meadows.

Problem:

A. Problem Analysis

1. What effect will grazing by cattle have on willow reproduction in a heavily grazed mountain meadow where the cattle are allowed to graze over the allotment at will every year for the full grazing season - June 1 to October 15?
2. What effect will grazing by cattle have on willow reproduction in a heavily grazed mountain meadow if the cattle are grazed on a deferred rotation basis where the allotment is divided into four pastures, each of which is grazed every year for $1/4$ of the full grazing season (full season is June 1 - October 15)?
3. What effect will grazing by cattle have on willow reproduction in a heavily grazed mountain meadow if the cattle are grazed on a rest and rotation basis where the allotment is divided into four pastures, each of which is left ungrazed one year out of four, and the cattle are grazed on a rotation basis in the remaining three pastures each year for $1/3$ of the full grazing season (full season is June 1 - October 15)?

B. Delimitations

1. The situation - Three cattle allotments on the Pole Mtn. Division, Medicine Bow National Forest have been set up to determine if three different systems of grazing will have varied effects on the forage species present on the areas.
 - a. One allotment (Lodgepole C&H) is not divided by cross fences and the cattle are permitted to graze at will over the entire allotment for the full grazing season (6/1-10/15) each year.
 - b. One allotment (Green Mtn. C&H) is divided by cross fences into four approximately equal sized pastures, and the cattle are grazed for $1/4$ of the full grazing season (6/1-10/15) in each pasture each year on a deferred-rotation basis.

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EXPERIMENT STATION

- c. One allotment (North Pasture C&H) is divided by cross fences into four approximately equal sized pastures, one of which is not grazed each year and the cattle are grazed for $1/3$ of the full grazing season (6/1-10/15) in each of the remaining three pastures. The entire set-up is rotated on an annual basis.
2. Location - willow patches in heavily grazed meadows in North Pasture, Green Mountain, and Lodgepole cattle allotments, Pole Mountain Division, Medicine Bow National Forest in Wyoming.
3. Approximate size of sample - three permanently marked willow clumps at each of three selected study areas in each pasture of North Pasture and Green Mountain allotments, and at three study areas in the Lodgepole allotment.
4. Period of study - measurements will be made between June 1, and June 15, from 1959 to 1963 inclusive.

Need for Study:

The theory has been advanced that willows in mountain meadows are prevented from reproducing where cattle use the meadow vegetation heavily during the summer grazing season. It has been suggested that if management was changed to a deferred-rotation or a rest-rotation system, the willow would be able to reproduce. Studies are necessary to determine the reaction of willow reproduction on mountain meadows under the different systems of management.

Procedure:

A. Data needed

1. Changes in heights of willow clumps.
2. Changes in crown spread of willow clumps.

B. Source of data

1. and 2. Measurements of permanently marked willow clumps.

C. Techniques

1. Select three willow clumps at each study area which show past use and measure crowns of each:
 - a. Maximum height,

b. Average crown spread. Two measurements of maximum spread taken at right angles to each other will be averaged.

2. Make photographic record of one willow clump at each study area.

Note: Where the willow clumps are more than 4 feet tall, it may be desirable to cut them back to ground line and make measurements on new sprouts produced from the root crown.

STUDY PLAN - ASPEN REPRODUCTION

Title: Effects of Three Systems of Cattle Grazing on Aspen Reproduction in Previously Heavily Grazed Mountain Meadows.

Problem:

A. Problem Analysis

1. What effect will grazing by cattle have on aspen reproduction in a heavily grazed mountain meadow where the cattle are allowed to graze over the allotment at will every year for the full grazing season - June 1 to October 15?
2. What effect will grazing by cattle have on aspen reproduction in a heavily grazed mountain meadow if the cattle are grazed on a deferred rotation basis where the allotment is divided into four pastures, each of which is grazed every year for $1/4$ of the full grazing season (full season is June 1 - October 15)?
3. What effect will grazing by cattle have on aspen reproduction in a heavily grazed mountain meadow if the cattle are grazed on a rest and rotation basis where the allotment is divided into four pastures, each of which is left ungrazed one year out of four, and the cattle are grazed on a rotation basis in the remaining three pastures each year for $1/3$ of the full grazing season (full season is June 1 - October 15)?

B. Delimitations

1. The situation - Three cattle allotments on the Pole Mtn. Division, Medicine Bow National Forest have been set up to determine if three different systems of grazing will have varied effects on the forage species present on the areas.
 - a. One allotment (Lodgepole C&H) is not divided by cross fences and the cattle are permitted to graze at will over the entire allotment for the full grazing season (6/1-10/15) each year.
 - b. One allotment (Green Mtn. C&H) is divided by cross fences into four approximately equal sized pastures, and the cattle are grazed for $1/4$ of the full grazing season (6/1-10/15) in each pasture each year on a deferred-rotation basis.

- c. One allotment (North Pasture C&H) is divided by cross fences into four approximately equal sized pastures, one of which is not grazed each year and the cattle are grazed for $1/3$ of the full grazing season (6/1-10/15) in each of the remaining three pastures. The entire set-up is rotated on an annual basis.
2. Location - aspen patches in heavily grazed meadows in North Pasture, Green Mountain, and Lodgepole cattle allotments, Pole Mountain Division, Medicine Bow National Forest in Wyoming.
3. Approximate size of sample -
 - a. One permanently marked 3-step transect at each of three selected study areas in each pasture of the North Pasture and Green Mtn. allotments, and at three study areas in the Lodgepole allotment.
 - b. Three permanently marked $1/100$ acre circular plots at each selected study area described in 3 a. above. The three transect stakes of each transect will be plot centers.
4. Period of study - measurements will be made between June 1, and June 15, from 1959 to 1963 inclusive.

Need for Study:

The theory has been advanced that aspen in mountain meadows are prevented from reproducing where cattle use the meadow vegetation heavily during the summer grazing season. It has been suggested that if management was changed to a deferred-rotation or a rest-rotation system, the aspen would be able to reproduce. Studies are necessary to determine the reaction of aspen reproduction on mountain meadows under the different systems of management.

Procedure:

A. Data needed

1. Characteristics of the herbaceous vegetation growing with the aspen.
2. Changes in numbers of young aspen stems.
3. Changes in heights of young aspen stems.

B. Source of data

1. Three-step transect data.
2. and 3. Measurements of young aspen stems on permanent plots.

C. Techniques

1. Compare transect hits on vegetation, litter, bare-soil, etc., for each pasture.
2. Count the number of live, young aspen stems on the permanent plots in each pasture.
3. Measure the maximum height of all live, young aspen stems on the permanent plots of each pasture.
4. Make photographic record of each study area.

EFFECTS OF THREE SYSTEMS OF CATTLE GRAZING ON WILLOW SPROUTS IN MOUNTAIN MEADOWS

INTRODUCTION

Heavily hedged, decadent, and dead willows are often found in heavily grazed mountain meadows. Frequently, this condition of the willows has been blamed to livestock use.

Wildlife biologists frequently defend the willows as important plants along fishing streams in mountain meadows, and as important food and/or cover for game birds and animals.

An assumption has been made that continuous summer-long grazing may be more damaging to willow sprouts than rotation grazing or rest-rotation grazing. This study was initiated to determine if these three systems of grazing would have different effects on the growth of willow sprouts.

LOCATION OF THE STUDY AREA

Willow meadows in North Pasture, Green Mountain and Lodgepole cattle allotments in the Pole Mountain Division of the Medicine Bow National Forest in southern Wyoming were selected for the study (Figure 4).

METHODS

Three willow clumps at each of three locations in Lodgepole allotment and in each unit of Green Mountain and North Pasture allotments were selected for study.

A picture was taken from an established camera point ($\frac{1}{2}$ inch reinforcing rod in a mound of stone) at each study location. Generally, it was

possible to include two of the three willow bushes at each study location in the picture. (Picture A, figures 1, 2 and 3).

After the picture was taken, the willow bushes were cut off a few inches above the ground to stimulate sprouting, and to reduce the sprouting to a comparable level for each bush. After cutting, a second picture was taken (Picture B, figures 1, 2 and 3) and each bush was tagged with a metal, numbered tag. Each bush was then "tied" by compass bearing and distance from the camera point.

In the spring of 1963, pictures were again taken from the camera points (Picture C, figures 1, 2 and 3). Also maximum height of sprouts above the original cutting level were measured in the spring of 1963.

RESULTS

The average maximum height of new sprouts in May 1963 for the willows studied in the rest-rotation grazed allotment (North Pasture) was 21.1 inches. In the ^{Deferral} rotation grazed allotment (Green Mountain allotment) average maximum height of new sprouts was 16.2 inches, and in the continuous, season-long grazed allotment (Lodgepole allotment) average maximum height of new sprouts was 3.5 inches (Table 1).

Ocular observation indicated that new willow sprouts from the bushes in Lodgepole allotment were much more heavily browsed than were those in either Green Mountain or North Pasture allotments.

One willow clump studied in Unit 3 of North Pasture allotment and one in Lodgepole allotment died during the period of the study. Cause of death is not known; however, it is doubted that grazing use was the cause of death.

DISCUSSION AND SUMMARY

New sprouts from willow bushes, which have been stimulated by cutting all stems off a few inches above ground are palatable to cattle. The cumulative effect of cattle browsing is reflected in the height growth of the new willow sprouts.

In the areas studied, continuous season-long grazing was considerably more damaging to new sprout growth than was either rotation grazing or rest-rotation grazing, and rest-rotation grazing was the least damaging of the three grazing systems.

Table 1 -- Average of maximum heights of new willow shoots in 1963.

Average Maximum Height In Inches -- 1963	
North Pasture:	
Unit 1	12.3
Unit 2	29.2
Unit 3	25.8
Unit 4	<u>17.0</u>
Average	21.1
Green Mountain:	
Unit 1	22.8
Unit 2	15.1
Unit 3	14.3
Unit 4	<u>12.4</u>
Average	16.2
Lodgepole Allotment	3.5

Figure 1. Close up view of two willow bushes at study location number 1 in North Pasture unit 3:
(A) Before cutting June 12, 1959,
(B) Immediately after cutting June 12, 1959, &
(C) On May 28, 1963.

Figure 3. Close up view of two willow bushes at study location number 1 in Lodgepole allotment:
(A) Before cutting June 12, 1959,
(B) Picture not available for 1959 after cutting, and
(C) On May 27, 1963.

Figure 2. Close up view of two willow bushes at study location number 1 in Green Mountain unit 2:
(A) Before cutting June 11, 1959,
(B) Immediately after cutting June 11, 1959, &
(C) ON May 27, 1963.